

## Impacts on the Environment and Biological Diversity of Chotiari Reservoir in Pakistan

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**Abstract:** EIA has the potential to accomplish sustainable development goals through better decision making but this potential is barely exploited in most of the developing nations such as Pakistan. The agricultural based economy of Pakistan mainly depends on the availability of fertile land and Indus Basin Irrigation System. While the extensive expansion and unsustainable growth in the sector is rapidly degrading ecosystems, their ecological services and the consequence situation is undermining the livelihoods of the rural poor. The paper explores root causes of poor performance of EIA in this sector by discussing the case of Chotiari Reservoir, where unwise decision making led to the destruction of habitats, biological diversity, ecological services, agricultural lands and livelihood resources. The results show that the degradation of livelihoods of poor has augmented the biodiversity destruction process in the region. The aim of the paper is to highlight shortcomings in the country's EIA framework and practice to promote biodiversity inclusive regional sustainability through well informed decision making on such infrastructure developments.

**Key Words:** EIA, Indus Basin Irrigation System, Sustainability, Chotiari Reservoir, Biodiversity, Livelihoods,

### Introduction

Under section 12 of Pakistan Environmental Protection Act of 1997, Environmental Impact Assessment (EIA) of all projects public or private is mandatory (GoP, 1997). The system of EIA in Pakistan was established under this act and a package of guidelines for preparation and approval of EIA was released with the act and updated for initial environmental examination /environmental impact assessment (IEE/EIA) later in 2000 (GoP, 2000).

The fairly good EIA framework of the country, though with some shortcomings, has not performed well to achieve the intended purpose of sustainable development and failed considerably to protect biodiversity. The paper discusses a case of reservoir construction in an ecologically rich area of the province Sindh in Pakistan, which has not only ravaged ecological habitats but also has diminished the natural resource dependant livelihoods of poor locals (Nauman, 2003). The aim of the paper is to improve the EIA process for better decision making on such developments for sustainability promotion of biodiversity and ecosystem services.

### Background of Reservoir Construction

Due to arid climate the country's agriculture, which is major contributor of gross domestic product, relies on the provision of irrigation water. To increase the cropping area and agricultural production the irrigation network expanded extensively in the 20<sup>th</sup> century (Alam et al., 2007). Flood irrigation with extensive-network induced ground water recharge that resulted in waterlogging and salinity impacts, especially in the flat land of Province of Sindh (Alam et al., 2007). To tackle the problem,

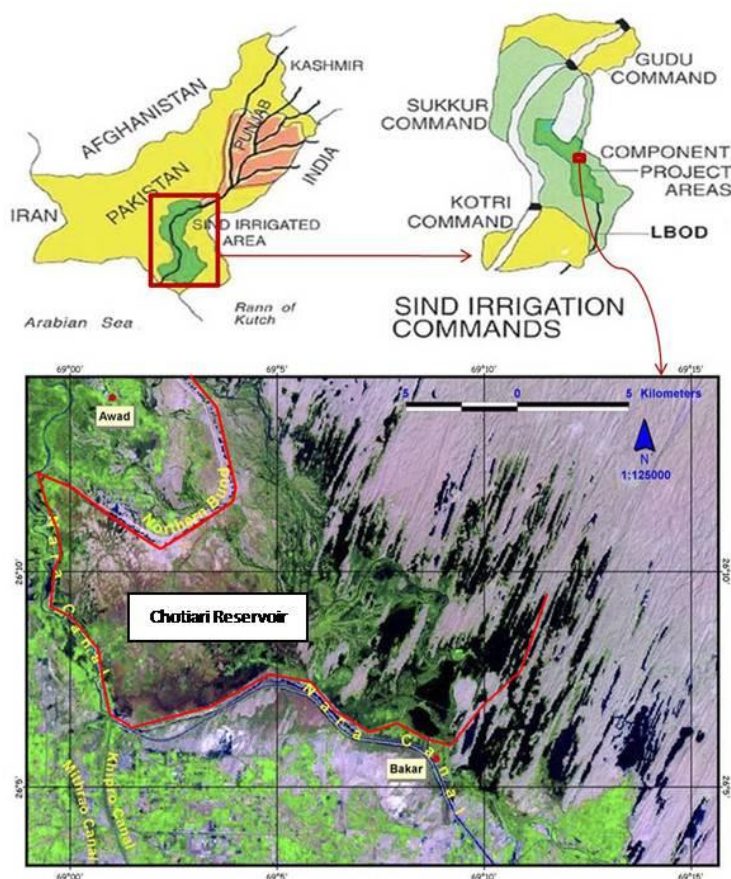
since the 1960s the Government of Pakistan (GoP), in assistance with World Bank, has been working to drain the effluents from the basin. Twenty years later, in the early 1980s GoP revealed that a sustainable and environmentally sound strategy was needed to remove the accumulating salt in the basin (GoP-LBOD, 1998). Under the strategy, the Left Bank Outfall Drainage (LBOD) project was executed at the tail end of the Indus river basin to provide drainage to 1.27 million acres in three districts (Nawabshah, Sanghar and Mirpur Khas) of Sindh Province (World Bank, 1984). Drainage was not the sole purpose of the project and other components were the Chotiari Reservoir and remodeling of the existing Nara Canal (GoP-LBOD, 1993).

### The Reservoir

Chotiari is an off-canal storage reservoir on Lower Nara Canal and is located 10-15 Kilometers northeast of Sanghar Town on the western flanks of the Achro-Thar Desert (Project EIA, 1998). The reservoir is constructed in a natural depression that was a cluster of lakes prior to construction. The Desert fringes the reservoir naturally on the eastern side while the other side embankments were constructed mainly along the left bank of Nara Canal.

The open water area of existing lakes was 4,000 hectares with some seasonal fluctuations while the enlarged reservoir would raise the open water surface to 18,210 hectares at 87.5 Foot Elevation Contour (FEC) the maximum storage level. Nara Canal, off-takes from Indus River at Sukkur Barrage, fills the reservoir through its Ranto tributary that makes an inlet to the reservoir.

The enlarged reservoir is designed to extend 2.5 times the water surface area of existing lakes and can retain 0.71 Million acre-feet (MAF) of water at its maximum storage level. It can flood 60,700 hectares of agricultural land (Project EIA, 1998). The reservoir is filled during high flow season of the Indus River in late summer Monsoon. The water is released, in the dry months of winter from January to April, for irrigation in one of the two cropping seasons of Pakistan.



### Project Map

Map 1: Chotiari Reservoir Location Map

Source: Figures adapted from FAO, 2002; Development of Research Programme in Irrigation and drainage in Pakistan- and remote sensing image from WWF-Pakistan, 2007; Preliminary Baseline Environmental Assessment Report under Indus Eco-region Conservation Program

### Ecological Importance of Project Site

Chotiari is an ecologically rich area and unique wetland complex. It is characterized by mosaic of diverse habitats of riverine forest, fresh and brackish water lakes, agricultural lands, rangelands, sand dunes scrub, reed beds and swamps. Despite a very hot and arid climate the site is biologically most diverse and rare in the region. A variety of faunal diversity exists here

that includes 14 species of large mammals, 19 species of small mammals, 109 species of birds, 58 species of reptiles and amphibians and about 53 species of freshwater fish (WWF-Pakistan, 2008).

The site has high ecological significance as it is home to many internationally important and endangered species listed in the IUCN Redlist. Among mammals it supports endangered species of Hog Deer (*Axis porcinus*) and Fishing Cat (*Prionailurus viverrinus*) and two vulnerable species of Chinkara (*Gazella bennettii*) and Smooth-Coated Otter (*Lutrogale perspicillata*). Among avifauna two species are worthy of particular attention. Marbled Teal (*Marmaronetta angustirostris*), a globally vulnerable migratory bird, visits and breeds in the area and Pallas's Fish-Eagle (*Haliaeetus leucoryphus*), also a globally vulnerable bird, resides in the area. The most important and globally endangered species of the complex wetland site is the Marsh Crocodile (*Crocodylus palustris*). Various surveys by different organizations and researchers reported different population of the species ranging from 50 to 200 (WWF-Pakistan, 2008). Hafeez in 2006 reported that Chotiari could be the largest reserve of crocodiles in Pakistan.

### **Environmental Impact Assessment of the Project**

The EIA report was quite sound in establishing the baseline of the site but it faced many shortcomings in impact identification and prediction. It identified some risks to Hog Deer and other key species of the site due to destruction of their habitats but failed to figure out any suitable mitigation. It did not provide the survey of adjacent habitats nor determine their carrying capacity for relocation of displaced fauna, yet the availability of adjacent habitats were given as justification for habitat loss (Nauman, 2003). In the report, it was opined that the reservoir enlargement would benefit crocodiles and waterfowl. This statement is doubted as seasonal flooding of the reservoir can destroy the nesting and eggs of crocodiles (Santiapillai et al., 2001). While waterfowl do not like submerged reed beds and swamps, the Marbled Teal especially is not adapted to enlarged lakes (EC & Birdlife, 2008).

The report absolutely failed to identify indirect and secondary impacts on biodiversity. Many resident birds lost their tree nesting due to submergence of riverine forest and similarly the Hog Deer habitat carrying capacity is undermined due to increased pressure of grazing owing to rangelands inundation in the reservoir. It completely failed to evaluate any alternative site or option. It did not justify the reservoir construction at the site, which is prone to high evaporation rate and seepage.

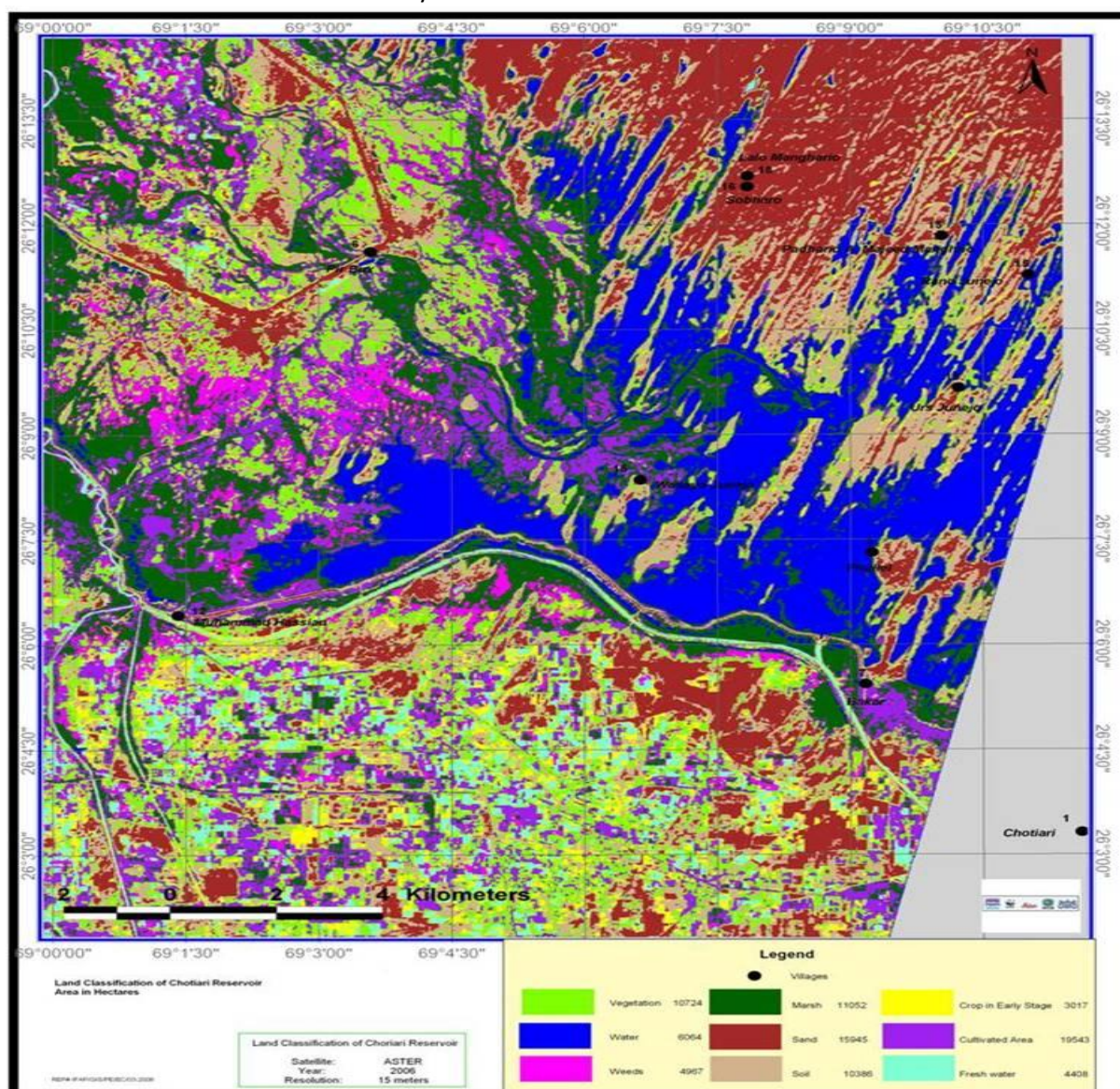
### **Present Situation**

The project not only has generated significant ecological impacts, but also resulted in immediate and long-term socio-economic consequences on local communities of farmers, fishermen and herders. Habitats of unique fauna and flora suffered from substantial losses and became fragmented. Excessive storage has submerged and destroyed the riverine forest and similar impact has been observed on rangelands that resulted in the loss of biodiversity and fodder. Increased water level in the reservoir has not only inundated the fertile land but also caused excessive water seepage to western and southern areas and subsequently adjoining agricultural lands became waterlogged, salinized and barren. Fish stocks of the reservoir are slowly depleting due unsustainable and overfishing practices.

The major income resources of local people the agriculture lands, fish stocks of lakes and rangelands (source of fodder for livestock) have been adversely affected and also the livelihoods of the people. The project has enhanced poverty in local communities and the locals are struggling to generate income on marginalized natural resources, which further exacerbated negative impacts on the habitats and associated biota.



Map 2: Indicates at least 30,000 hectares of cultivable land are under direct threat of the reservoir  
Source: WWF-Pakistan GIS Laboratory



It was claimed that the reservoir at its full capacity would irrigate 60,700 hectares of land for winter cropping but it is never filled to its full capacity due to unavailability of water. It is estimated that increased levels of water will destroy about 30,000 hectares of cultivable land in and around the reservoir. Considering other factors of rangelands destruction, fish depletion, deforestation and biodiversity loss, one can envisage that the economic losses for this development are much higher than its benefits.

## Conclusions

In Pakistan, federal and provincial environmental agencies and departments under ministry of environment are responsible for review and approval of both public and private projects. The same agencies are responsible for updating of environmental legislation and preparation of necessary guidelines. Chotiani Reservoir is one of many projects executed in Pakistan in which EIA has failed to address the issues of biodiversity, sustainability of natural resources and socio-economic rights of local communities. The project EIA can be characterized by absence of alternative analysis, poor evaluation of socio-economic impacts, faulty scoping of biodiversity impacts and non-compliance of mitigation measures.

EIA does not appear to be an effective tool to safeguard the environment and the socio-economic fabric of the communities in Pakistan (Aslam, 2006). In developing countries many loopholes and weaknesses have been identified in EIA framework and practice (Ahmad et al., 2002) that leads to bad decision making and Pakistan is not an exception in this regard. The country's legislative and guideline packages are much comprehensive but the obstacles to produce desired quality EIAs include the following.

- Inadequate evaluation of alternatives
- Poor and inadequate guidelines on methodology of impact scoping especially on impact identification and predictions. And, even availability of guidelines does not mean that they are followed in practice (Fuller, 1999)
- Inadequate capacity of agency and departments to review and analyze the reports
- Inadequate coverage of impacts on biodiversity
- Weak implementation of mitigation and biodiversity offset measures
- Absence of follow-up procedures
- Biased reports preparation by consultants as most of the times their interest lies in projects
- Unavailability of baseline data and information especially about biodiversity
- Poor knowledge and understanding of EIA actors about values of biodiversity
- No assignment of economic or intrinsic value to ecology while evaluating the project costs
- Powerful lobbies influence on decision making of public sector projects

### **Recommendations**

The legal framework for EIA in country is strong enough (Nadeem et al., 2008) and with inclusion of follow up procedures can be tapped to result in desired quality and biodiversity inclusive decision making. It needs strong political will and institutional capacity to take action against violators of EIA. The following measures can be taken to improve the quality of EIA for better decision making to attain environmental sustainability.

- Capacity of EIA directorate of EPA should be enhanced, adequate and qualified staff especially about biodiversity should be appointed. More powers and resources should be provided to directorate for better inspection and monitoring
- NGOs and academia can be approached by EPA to involve them in review process for better analysis of reports
- Registration and certification of consultants, their rating and ranking will promote a culture of competition and that will lead to good quality reports. If it can be coupled by training them to how to better address biodiversity in EIA by international experts in workshops and seminars will certainly help in achieving the desired goal of sustainability.
- Consultant and proponents should be encouraged to involve in public throughout the process of EIA preparation. Engineering consultants should be asked to involve a biodiversity specialist while conducting an EIA
- Follow-up-procedure should strictly be adopted
- Awareness about the values and importance of biodiversity should be raised among all stakeholders of EIA
- Access to court should be given to local public for controlling and evaluating EIA and environmental mitigation matters

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